Implementing Beat Amplitude Measurements

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Outline

- Objective
- Measurement Operations
- Fringe Characterization Operation & Results
- Shot Results

Objective

- Set the interference amplitudes at shock breakout to within a factor of 2 of an optimum value
  - Due to our goal to return quality data on all PDV channels
- In order to predict fringe amplitudes at shock breakout we must create fringes prior to the shot.
- Methods for performing this prediction are constrained;
  - No touching the target to change the distance between the probe and target. (no ice, cooking in the sun, dropped wrenches, etc.)
  - No addition of moving parts into the target to change the target-probe spacing

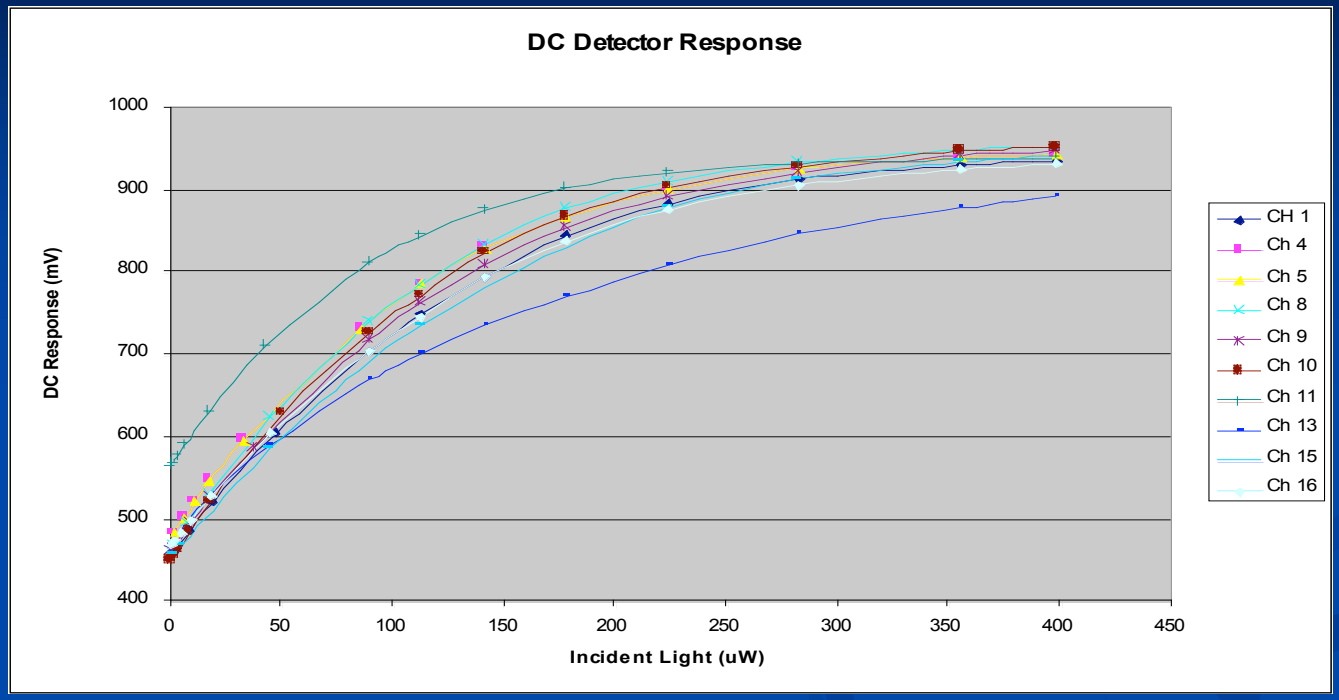
How to make fringes without changing the target-probe spacing

- Use a tunable laser to scan the PDV wavelength to create fringes

Measurement Operations

- To flatten the beat amplitudes near shock breakout over all channels we use the following processes
  - DC Detector Response Curves
    - Part of the laser set point determination
  - Target Fringe Measurements
    - Determine the maximum fringe contrast the target is capable of producing and part of the laser set point determination
  - Fringe Characterization
    - Establish a similar set-point over all channels to ensure maximum fringe contrast and that the beat amplitudes near shock breakout over all channels are similar to within a factor of 2.

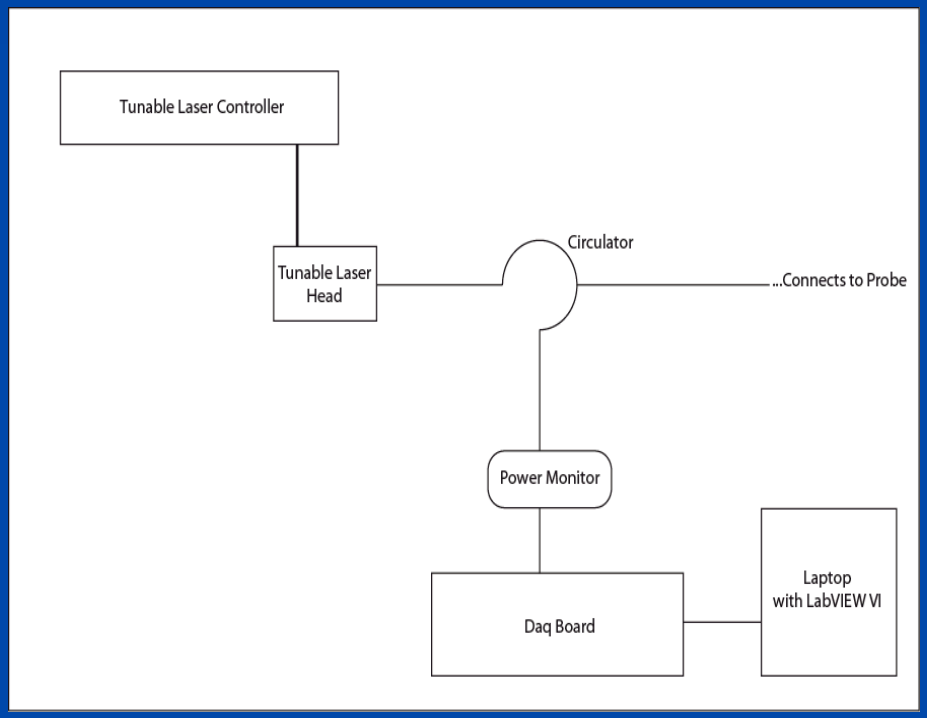
DC Detector Response

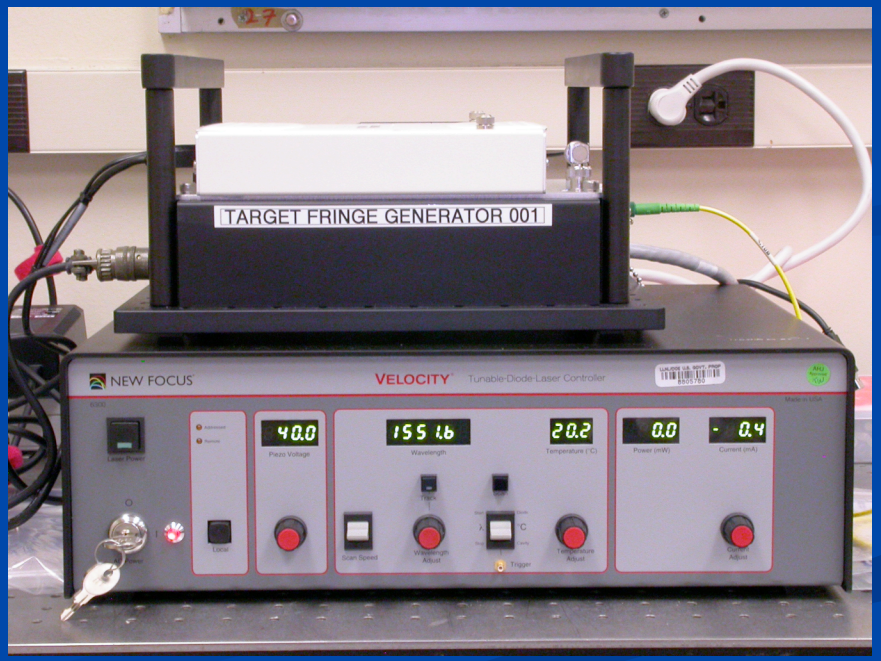


- The system laser power set point is determined by the target fringe contrast and the detector response
- We've measured the detector DC response
- This information was used to determine the laser set point during shots at 341

Target Fringe Generator

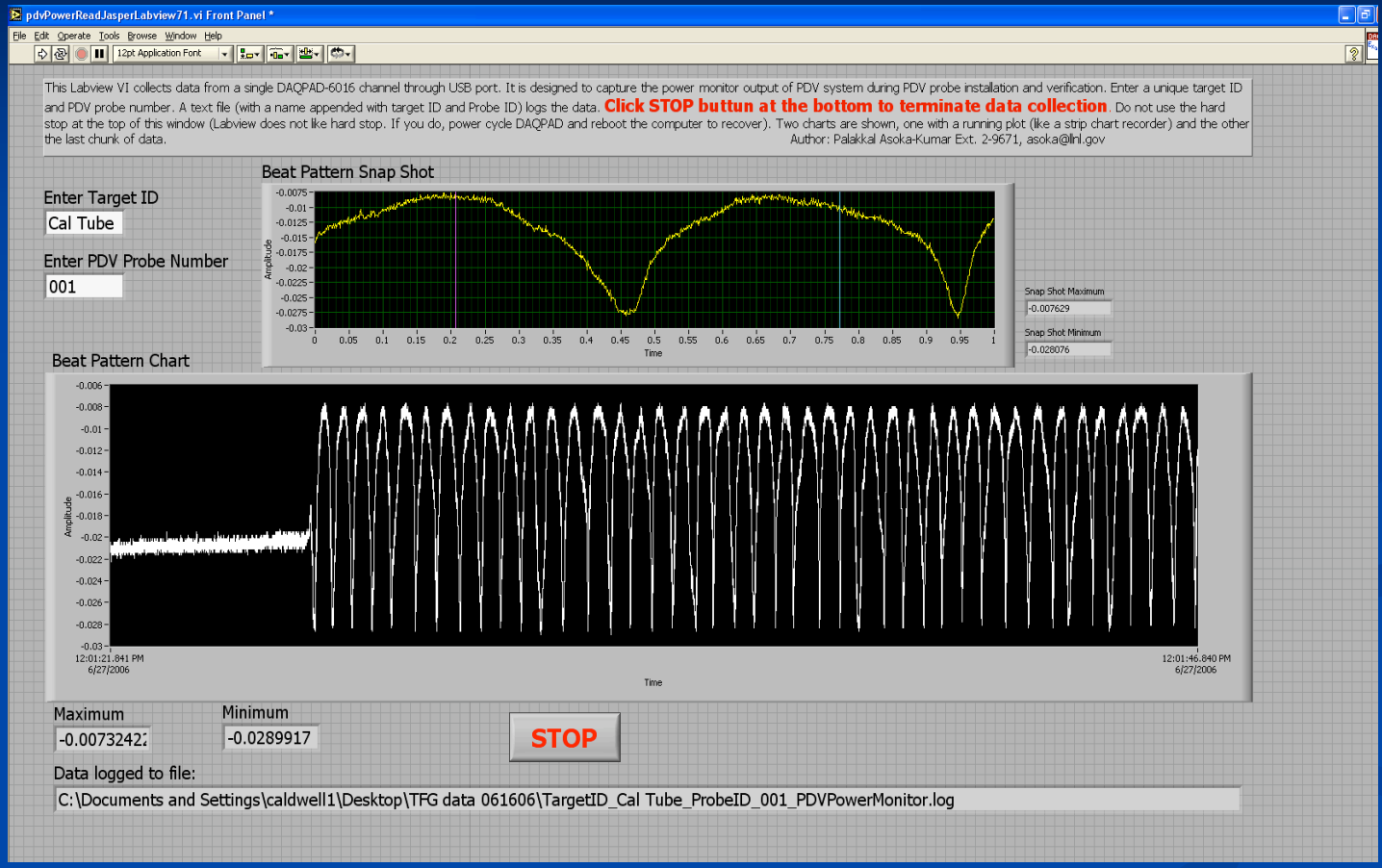
- The target fringe generator (TFG) will be used during each stage of the target build to measure the maximum fringe contrast the target is capable of producing





Target Fringe Generator Hardware

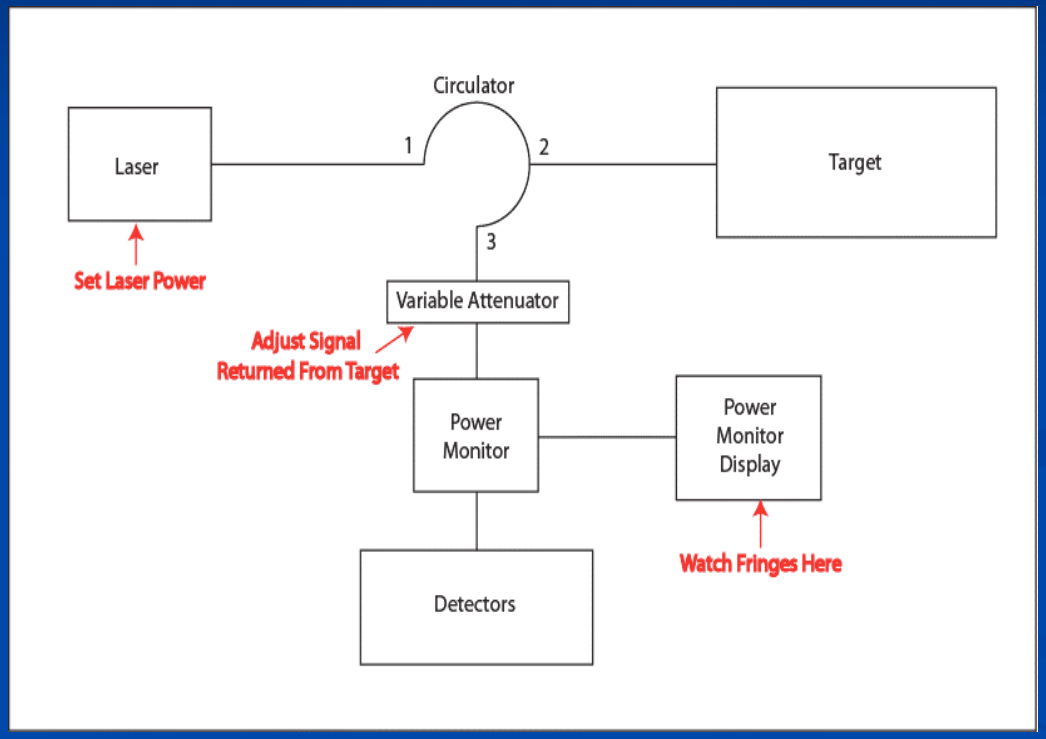
Target Fringe Generator Data



Time [s] versus Beat Amplitude [dBm]

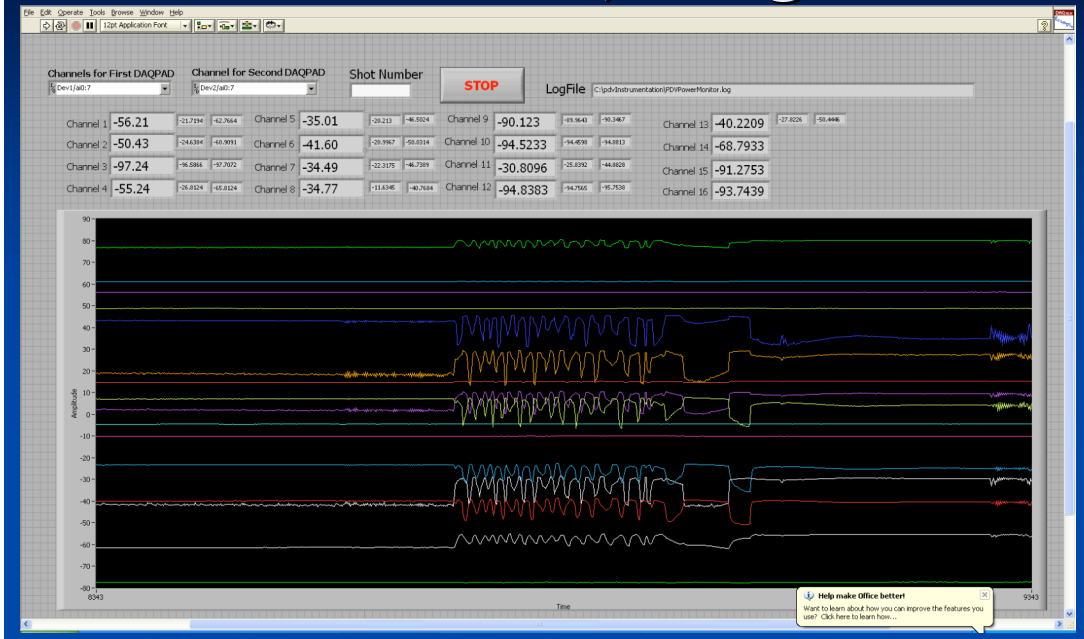
Taken using a calibration tube

Fringe Characterization Operations



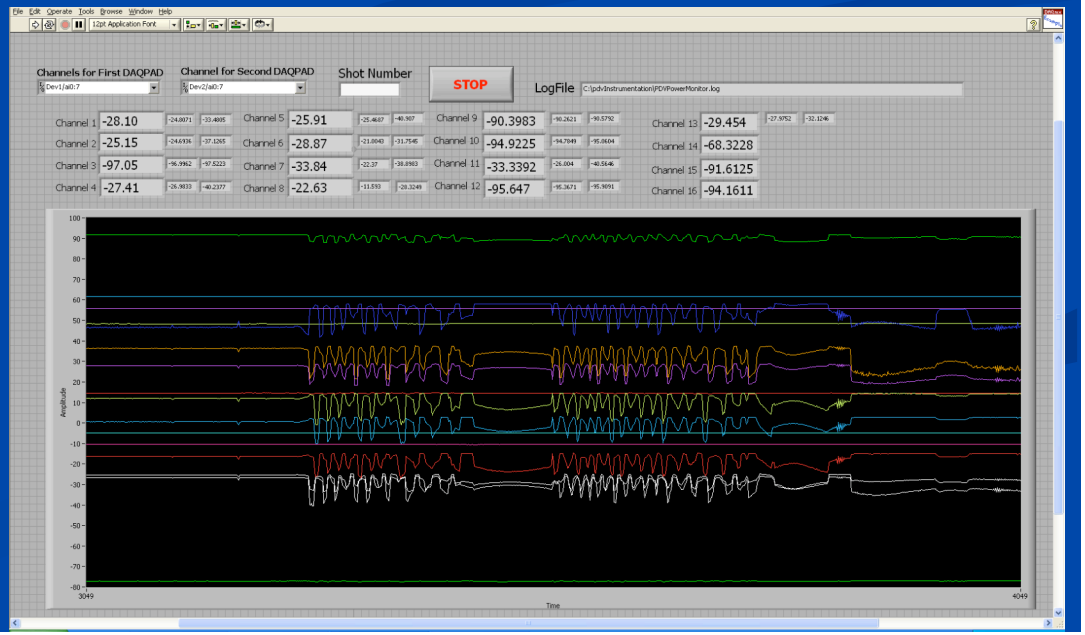
- This process will be used to establish a similar set point over all PDV channels and to obtain the highest contrast fringes the target is capable of producing.

Example of Fringe Characterization Before & After adjusting variable attenuators



Before

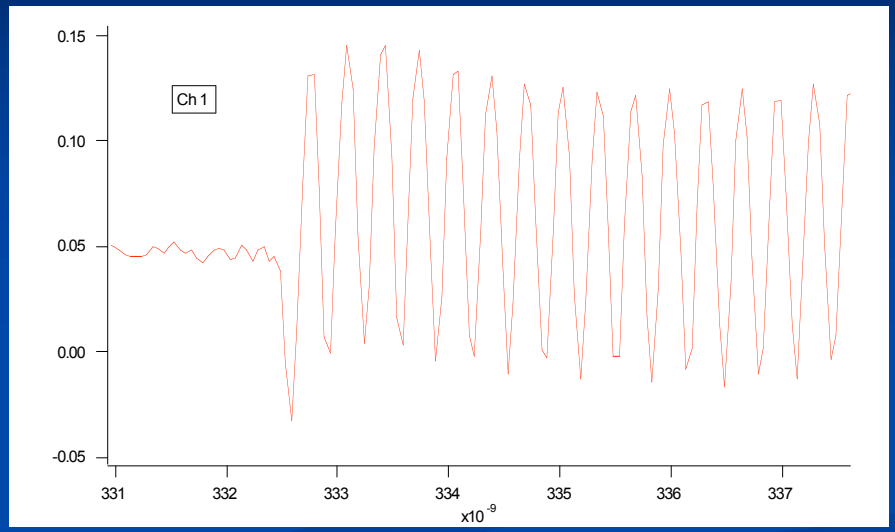
After

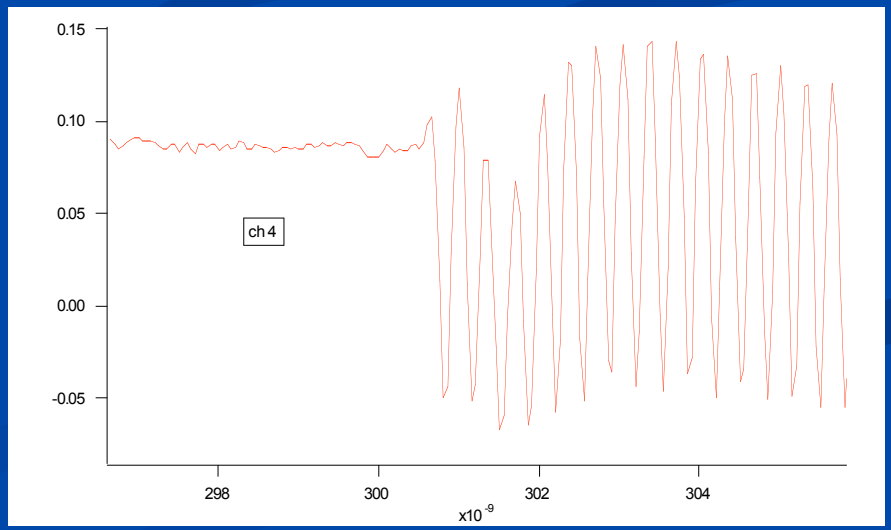


Shots at 341 have demonstrated the processes we've developed will meet the goal to return 100% quality data

Measured Beat Amplitude near shock Breakout	
Channel	Beat Amplitude (V)
1	0.144
2	0.162
3	0.142
4	0.163
5	0.185
6	0.174
7	0.176
8	0.176
9	0.146
10	0.16
11	0.126
12	0.108
13	0.217
14	0.14
15	0.046
16	(Broken Fiber) 0.006

Raw PDV Data





Mean beat amplitude is 151mV with a 25% standard deviation

Conclusion

- Using these methods we will be able to accurately predict the beat amplitudes near shock breakout and say with confidence that there will be a 100% return of quality data.